Model errors with respect to the ARGO data set

(comparing sens01 and argo_1992_2010.nc)

When, where, how much, and why the model is wrong?

- T vs time :
  - clear seasonal variability at 5 m depth:
    - ~ Feb-Jul: model is too warm
    - ~ Aug-Jan: model is too cold
  - magnitude: ~ ± 1°C mean model/data mismatch at 5 m depth
  - the 2005 to 2008 span has a higher contribution to the T cost, not because of a higher mismatch of the model with respect to the observation (at least not only), but importantly due to a higher amount of data measurements in this last period
  - the model is globally too cold in the first 150 m depth and at depth [1000, 2000] m, and too warm at mid-depth
  - the bigger contribution to the T cost happens at depth [500, 1800] m

- T vs latitude:
  - the model is globally too cold in the first 110 m
  - the [-60, -45] ° of latitude range has a higher contribution to the T cost, not because of a higher mismatch of the model with respect to the observation (at least not only), but importantly due to a higher amount of data measurements at lower latitudes
  - the bigger contribution to the T cost happens at depth [500, 1800] m, and between -55 and -60 ° latitude
  - particularly high contribution to the T cost at:
    - -48° latitude at [5, 220]U[500, 1800] m depth
    - -50 ° latitude at [500, 1800] m depth
    - -55 ° latitude in general
    - -67 ° latitude at [1500, 1900] m depth
  - [-75, -65] ° latitude:
    - [5, 70] m depth: too cold
    - [70, 200] m depth: too warm
    - [200, 600] m depth: too cold
    - [600, 2000] m depth: globally too warm
  - [-65, -55] ° latitude:
    - [5, 100] m depth: too cold
    - [100, 400] m depth: too warm
    - [400, 2000]m depth: too cold
  - [-55, -45] ° latitude:
    - [5, 250] m depth: too cold
    - [250, 1400] m depth: too warm
    - [1400, 2000] m depth: too cold

- T vs longitude:
    - East Weddell Sea: too warm
    - West Weddell Sea:
        - too cold at [5, 260]U[1100, 2000] m depth
        - too warm at [260, 1100] m depth
    - Berlingshausen Sea:
        - too cold at [5, 135]U[1700, 2000] m depth
        - too warm at [135, 1700] m depth
    - Amundsen Sea:
        - too cold at [5, 230]U[1700, 2000] m depth
        - too warm at [230, 1700] m depth
    - East Ross Sea:
        - too warm at [5, 50]U[120, 1900] m depth
        - too cold at [50, 120] m depth
    - West Ross Sea:
        - always too cold
        - highest mean model-data mismatch (~-1°C)
    - Pacific Ocean:
        - too cold at [5, 130]U[600, 2000] m depth
        - too warm at [130, 600] m depth
    - Indian Ocean:
        - too cold at [60, 140]U[800, 2000] m depth
        - too warm at [140, 750] m depth
    - particularly high contribution to the T cost at
        - -90° longitude at [500, 1200] m depth
        - -180 ° latitude at [1000, 1900] m depth

- S vs time
    - salinity too high in the model overall
        - [50, 1500] m depth: salinity too high
        - [5, 50] U[1600, 1900] m depth: salinity too low
    - seasonal variability:
        - at 15 m depth: Oct-Jan has a higher relative mean model-data salinity mismatch salinity than Feb-Sep
        - at 55 m depth: Jan-May has a higher relative mean model-data salinity mismatch than Jun-Dec
        - at 115 m depth: Mar-Jul has a higher relative mean model-data salinity mismatch than Aug-Feb
        - at 220 m depth: Jun-Nov has a higher relative mean model-data salinity mismatch than Dec-May
    - the bigger contribution to the S cost happens at [500, 1100] m depth
    - the 2005 to 2008 span has a higher contribution to the S cost, not because of a higher mismatch of the model with respect to the observation (at least not only), but importantly due to a higher amount of data measurements in this last period

- S vs latitude
    - [-50, -45] ° latitude:
        - [5, 280] m depth: salinity too low
        - [280, 1800] m depth: salinity too high
    - [-65, -50] ° latitude:
        - [15, 1300] m depth: salinity too high
    - [-75, -65] ° latitude:
        - [65, 1200] m depth: salinity too low
        - [15, 65]U[1200, 2000] m depth: salinity too high
    - the [-60, -45] ° of latitude range has a higher contribution to the S cost, not because of a higher mismatch of the model with respect to the observation (at least not only), but importantly due to a higher amount of data measurements at lower latitudes

- S vs longitude
    - East Weddell Sea:
        - too low salinity at [5, 15]U[220, 1800] m depth
        - too high salinity at [15, 220]U[1800, 1900] m depth
    - West Weddell Sea:
        - too low salinity at [5, 80]U[1400, 1900] m depth
        - too high salinity at [80, 1400] m depth
    - Berlingshausen Sea:
        - too low salinity at [5, 135]U[1700, 1900] m depth
        - too high salinity at [135, 1700] m depth
    - Amundsen Sea:
        - too low salinity at [5, 230]U[1700, 1900] m depth
        - too high salinity at [230, 1600] m depth
    - East Ross Sea:
        - too high salinity at [5, 50]U[125, 1900] m depth
        - too low salinity at [50, 125] m depth
    - West Ross Sea:
        - always too low salinity
    - Pacific Ocean:
        - too low salinity at [5, 135]U[650, 1900] m depth
        - too high salinity [135, 650] m depth
    - Indian Ocean:
        - too low salinity at [35, 135]U[800, 1900] m depth
        - too high salinity at [135, 750] m depth
    - particularly high contribution to the S cost at
        - -90 ° longitude (at [500, 1200] m depth)
        - -170° longitude (at [1100, 1900] m depth)